NORTHEASTERN FOREST
EXPERIMENT STATION

REPORT

1968

NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
RICHARD D. LANE, DIRECTOR

1969

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REPORT 1968

Northeastern Forest Experiment Station

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NORTHEASTERN FOREST EXPERIMENT STATION • • 1969
R. D. Lane, Director

1968

1968 WAS A YEAR OF PROGRESS at the Northeastern Forest Experiment Station. Our scientists made many outstanding contributions as well as advances in their research on critical forestry problems. We shifted direction in a few of our programs, changed Assistant Director assignments to obtain a better balance, pushed ahead with laboratory planning and construction, and began to mature in two new service functions. The highlights of our accomplishments in 1968 are summarized here.

RESEARCH CONTRIBUTIONS

We have selected for this report only a few of the many contributions made by our scientists during the year. These illustrate the scope and nature of our program. The annotated list of our publications for 1968 included here provides a more complete record of our accomplishments. Most of these publications are available. If you want any of them, just write to us.

INSECT & DISEASE RESEARCH

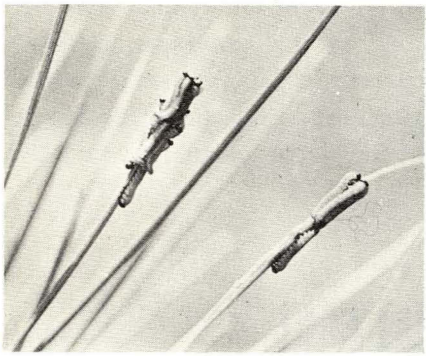
Progress Toward Biological Controls

One of the most exciting and promising developments in 1968 was the progress made in developing biological control systems for forest insects. Discoveries made and knowledge at hand have brought us to the threshold of biological replacements for chemical pesticides. But much research remains to be done before biotic elements can be integrated into practical control systems.

For our initial effort in the development of biotic controls, we have selected the nuclear polyhedrosis virus of the European pine sawfly, *Neodiprion sertifer* (Geoff.). Several agencies are cooperating with us in this research, including: (1) the Northern Area, State and Private Forestry, USDA Forest Service; (2) the Oak Ridge National Laboratory; (3) the Department of Health, Education and Welfare; and (4) the Department of Interior. Together we—

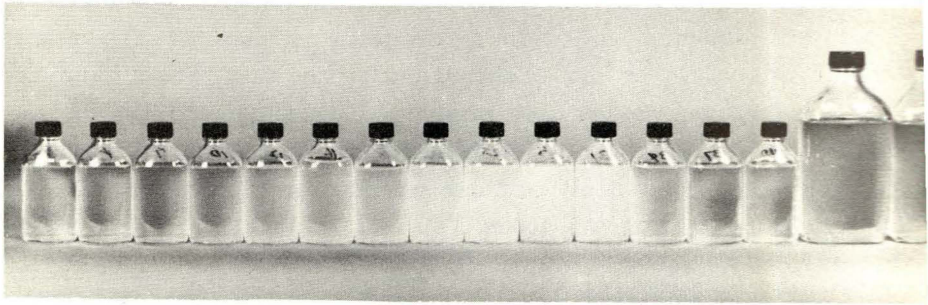
- Have developed a standardized method for mass-producing the virus.
- Through the assistance of Dr. N. Anderson, Oak Ridge National Laboratory, produced the virus in a

BIOLOGICAL CONTROL OF THE EUROPEAN PINE SAWFLY



The pest.

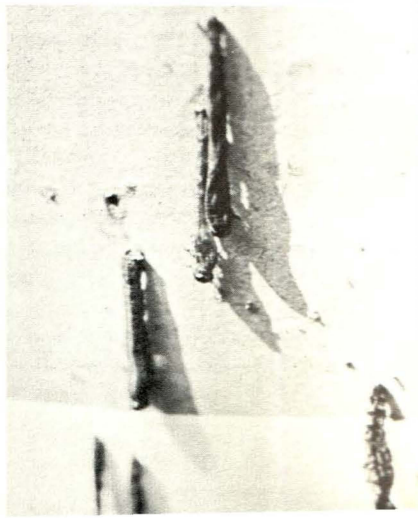
The control virus (x60,000).



The purified virus produced at Oak Ridge.

The damage it does.

Virus-killed larvae.



form virtually free of contaminating organic material and ideal for testing for its effects on other organisms.

- Are evaluating the effects of the pure virus on small mammals, shellfish, and other insects.

Borer Identification Simplified

A new method of identifying five primary oak borers has been found. Before this discovery these insects could be identified only by cutting infected trees and removing the larvae. Now these borers can be identified by hand-lens examination of the shape, length, color, and solidity of frass they produce. This method allows the determination of larval development stages, molting periods, and mortality patterns. Furthermore, it makes prediction of adult emergence possible.

Air-Pollution Injury

The chlorotic dwarf disease of eastern white pine results from air-pollution injury to the foliage of genetically susceptible trees. For the first time, the production of field symptoms on genetically susceptible trees was directly related to ambient levels of single and multiple pollutants in white pine plantations. We found that ozone and sulphur dioxide, independently or together, promote early symptoms of needle mottling and premature defoliation. This may clarify some of the other physiogenic needle blights of white pine when recorded levels of single gases are too low to damage trees.

Disinfecting Oak Logs

A number of European countries have embargoes on oak grown within the range of the oak wilt disease in the United States. In an effort to restore these markets, we investigated various means of disinfecting wilt-infected logs. Now, development and testing of reliable and practical treatments to eliminate the oak wilt fungus from infected logs have been successfully completed. Fumigation with methyl bromide or moderate heating in hot air or hot water will kill all of the fungus in such material. These treatments will allow overseas shipment of oak logs—pending approval by the proper authorities—without danger of spreading the wilt pathogen.

HOW CANKERS DEVELOP

This section of a red maple stem illustrates a new theory about cankers: a wedge of fungus pushes into the outer bark, splitting the bark and squeezing the cambium. The pressure kills the cambium, and the canker grows.

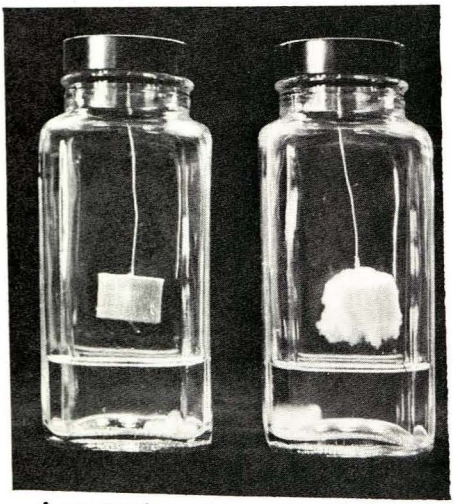
How Cankers Develop

The common explanation for cankers is that the living sapwood and cambium are attacked by the fungus after it becomes well established in the tree. Our studies on hundreds of dissected trees lead us to offer this explanation: a mass of fungus material pushes as a wedge into the outer bark; this wedge splits the bark and squeezes the cambium; the pressure kills the cambium; and the canker grows in size.

Discoloration and Decay

There is increasing evidence that successions of organisms following wounding play a major role in the decay process in living trees. In a recent study, columns of discolored and decayed wood associated with 9-year-old inoculations with heart-rot fungi and contiguous clear wood in oaks were mapped for specific gravity, pH, ash, microorganisms, and degree of susceptibility to decay by several heart-rot and sap-rot fungi after heat sterilization. General patterns for changes in tissues and successions of microorganisms were found among the decay columns. More information is being gathered to determine if heart-rot fungi decay wood only after the wood has been altered in some way.

DECAY PROCESSES



A succession of organisms is important in the decay of living trees. Both of these samples of sugar maple were inoculated with *Pholiota* sp. The clear wood (left) was not affected, but the decayed wood (right) was decayed further.

TIMBER MANAGEMENT RESEARCH

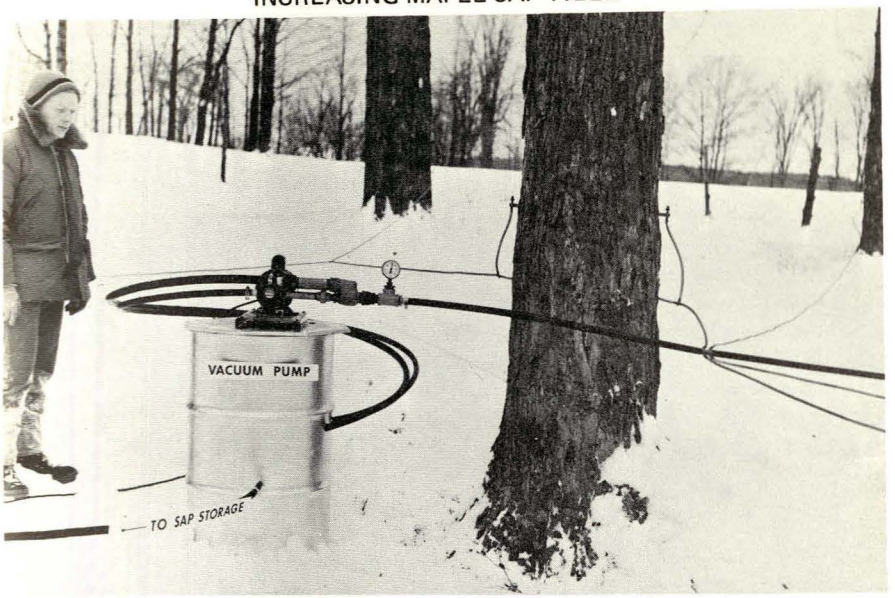
Increasing Maple Sap Yield

Major increases in sugar maple sap yield are now possible as a result of research on plastic tubing collection systems at Burlington, Vt. Yield increases of 40 percent were obtained through the use of aerial unvented tubing—rather than the more common vented tubing. Discovery that this increase was related to natural vacuum that develops in the unvented lines led to the application of vacuum pumps, which increased yield by more than 300 percent over unvented, unpumped tubing lines.

A New Seeding Machine

Direct-seeding procedures for white pine in the Northeast can now be considered operational. Recent studies of the basic environmental factors affecting white pine germination and seedling survival have led to the development of a furrow seeder that will provide the needed seedbed conditions. The seeder—which was developed at Durham, N. H., in cooperation with the Maine Forest Service—oper-

INCREASING MAPLE SAP YIELD



Our researchers in Vermont have discovered that vacuum pumping can increase sap yield of sugar maple trees by more than 300 percent.

NEW SEEDING MACHINE

This new furrow seeder makes direct seeding possible on the stony soils of the Northeast.

ates well on the moderately steep terrain and stony soils of the Northeast. Initial trials of the unit have given good results at a cost of $5 to $10 per acre.

WATERSHED MANAGEMENT RESEARCH

The Nutrient Cycle

Cooperative studies with Dartmouth and Yale on a New Hampshire hardwood watershed totally cleared—and kept bare with herbicides—showed that most nutrient losses (except sulfates) increased during the first year from 3 to 100 times over losses before clearing. However, cutting also results in more nutrients available for new regeneration, and it is likely that any

nutrient losses from cutover areas that are allowed to regenerate will quickly become normal. Further research is planned on the nutrient cycle, as related to prompt regeneration. These studies contribute to both the International Hydrological Decade and the International Biological Program.

Revegetating Mine Spoils

Progress has been made on the revegetation of extremely adverse mine spoils with establishment of grasses and legumes on acid spoils in Kentucky and with crown vetch on anthracite breaker refuse in Pennsylvania. However, our horizons in mined-area restoration research are widening. We realize that solving the problems of protecting the land and water resources in mountainous country will require study of the entire coal-mining operation, from the first bulldozer pass to the last tree planted. And in cooperation with state, university, and industry groups, we are developing a program of mining-methods research.

MINE SPOILS

To develop ways to revegetate mine spoils, we are studying the entire coal-mining operation.

FOREST RECREATION & WILDLIFE RESEARCH

A Management Tool for Campgrounds

Our recreation research is giving campground operators new knowledge about effective management. From one of our studies, we developed demand curves for camping within the New Hampshire State Park system. This study indicates that camping fees, in addition to raising significant sums of money, can also be a useful management tool for redistributing camping pressures—because some parks and regions of the State have more elastic demand than do others. A comparison of campers having elastic and inelastic demands for camping has also yielded a number of campground marketing clues that can be used to raise attendance at commercial as well as publicly owned campgrounds.

Quantifying Scenic Beauty

Competition and pressure for land have accelerated the need for managers to understand the interrelationships between natural features in a landscape and the public's preferences for that landscape. A recent recreation-

MEASURING BEAUTY

Our recreation researchers are finding ways to quantify the landscape features that determine what attracts people.

oriented study identified the quantitative variables in landscape photographs that were significantly related to public preference for those landscapes. An equation was developed that used six variables and accounted for 66 percent of the variation in selection of preferred landscape photographs.

Management and Game

Even-aged timber management of the hardwood forests of the Northeast is replacing selective management in many places to increase timber production. However, we do not know

TIMBER & GAME

Trapped and marked, this wild turkey will be used in studies of how timber-management methods affect game populations.

how even-aged management affects forest game populations. To provide some answers, we have started a study of this, and as a part of it we are trapping, color-marking, and releasing wild turkeys where even-aged management is being practiced.

TIMBER PRODUCTS & MARKETING RESEARCH

Hardwood Flooring Costs Less

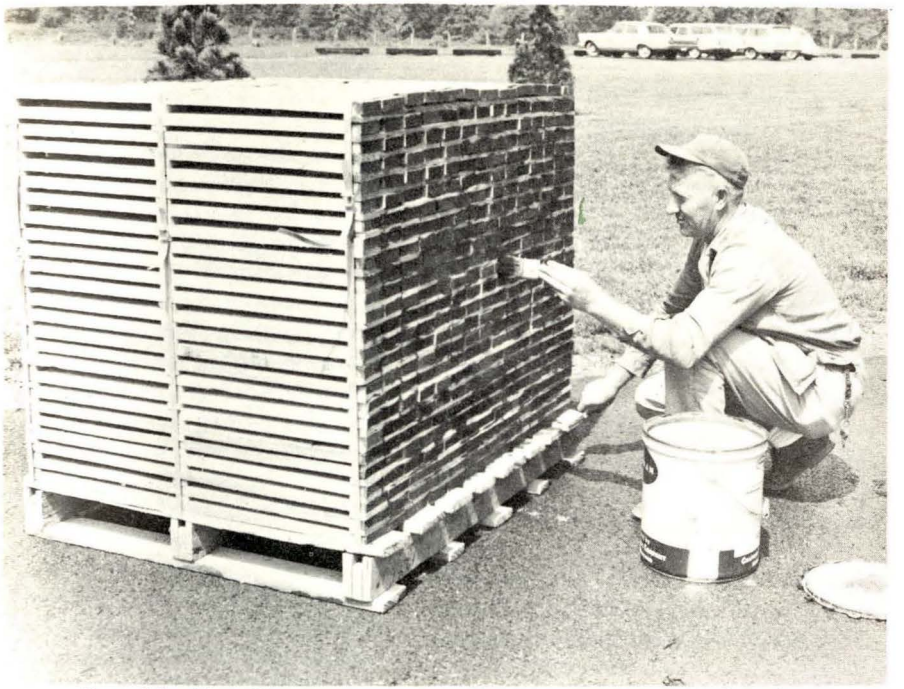
Hardwood flooring costs less than either composition tile or carpet. A national study of comparative maintenance and long-term costs of residential flooring materials showed that hardwood floors had the lowest annual maintenance costs and lowest long-term cost when compared with composition tile and carpeting. This information should be helpful to the buyer in selecting the flooring material that is best suited to his needs.

Better Lumber from Low-Grade Logs

Short clear lengths of lumber can be cut from lower grade hardwood logs, but the high cost of handling and drying this short material seldom paid its cost of production. Scientists at our Princeton Laboratory have developed a new method for processing the short segments of clear lumber from low-grade logs. Flooring blanks and pallet cuttings were manufactured from green oak lumber, graded, and then dried in palletized loads bound with flexible strapping. Handling and drying costs were reduced, for only one stacking and unstacking operation was needed; the material was easily moved by forklift truck; and only usable material was dried. This method, adaptable to other small wood pro-

HARDWOOD FLOORING

A nationwide study showed that, in long-term cost, hardwood flooring costs less than composition tile and carpeting.



By unitized handling and seasoning, Station scientists have found a way to recover and use short pieces of lumber cut from low-grade logs.

ducts, could expand the use and markets for lumber cut from low-grade logs.

How to Select Young Crop Trees

Tomorrow's timber must come from the young trees growing in the forest today, but only a few of the young trees in the forest will grow into high-quality timber trees. Our scientists have developed a method the forest manager can use to select those young trees in the forest that have the potential of producing high-quality wood. Then these selected trees can be managed to supply the timber that will be needed 25 years from now.

Wooden Pallets for DOD

The Department of Defense uses many different kinds of pallets in shipping materials throughout the world. At times they find it difficult to obtain the kinds and quantities of pallets they need within a specified time. Our marketing researchers made a comprehensive study of the Department of Defense market for pallets. Their report describes the kinds and quantities of pallets needed, when and where the pallets are needed, how the pallets are purchased, sources of pallet supply, pallet prices, and problems associated with selling pallets. This information should help the suppliers sell their pallets.

FOREST ECONOMICS & SURVEY

New Cutting Guides

In a joint study by our forest economics and timber management research people, the concepts of quality index valuation and financial maturity were combined with silvicultural concepts to develop cutting guides for several species of Appalachian hardwoods. The expected rates of value increase over a 10-year period, based on growth increases, quality improvements, and market values were calculated and used to determine tree sizes at financial maturity by tree species, vigor classes, site indexes, and rates of return. It is anticipated that this work will result in greater consideration of the economic factors that affect determination of tree and stand maturity.

Analyzing Investment Opportunities

In 1968 we published an analysis of timber-stand-improvement investment opportunities in Appalachian forests. This work provides a valuable economic tool for the administrator faced with choosing work projects to favor in planning a timber stand-treatment program. For the projects evaluated, the study showed that priority for program funds would logically go to stand-improvement projects in immature timber stands on above-average sites. Rates of return are generally inadequate to justify timber-stand-improvement projects for oak timber stands over 60 years old or in situations where high costs and low returns are anticipated. Similarly, unless nontimber benefits are important, type-conversion projects probably would not be undertaken where oak site index is less than 50 feet.

Forest Survey Data Current

After a year's effort in reconciling timber inventories, net annual growth, and timber removals, the Forest Survey has developed current timber resource data as of 1 January 1968 for all the Northeastern States. Stand tables by species groups and other specifications were punched into cards for inputs in the TRAS (Timber Resource Analysis System) program. Outputs from the high-speed electronic computer at the University of Pennsylvania provided the updated estimates.

This updating shows that we now have 97.5 billion cubic feet of growing stock in the Northeast, up 7.6 percent from that reported in 1963. Sawtimber volume totals 198 billion board feet. Net annual growth from 1967 amounted to 2.5 billion cubic feet, but removals for the year totalled only 0.9 billion cubic feet. Sawtimber removals amounted to about one-half the volume of net annual growth.

Fast Data Processing

The northeastern forest inventory data-processing system, widely used by the U.S. Forest Service in Forest Survey and National Forest inventories, is a major contribution to natural resource management where large volumes of resource data must be reduced to meaningful statistics about the resource. The system, designed for use with large, modern, high-speed computers, provides all the information channels and detailed procedures necessary and requires the minimum of manual data manipulation consistent with its flexibility. The result is a capacity for consistent, rapid, low-cost processing. The key to the system's success is that it is flexible.

PLANS & PROGRAMS

At Berea, Kentucky, we are replacing our work in hardwood silviculture with research in manipulation of vegetation with herbicides. This is the only research of its kind in the Forest Service devoted exclusively to northern hardwood types. Initially, we will screen new herbicides and develop methods of using them for the cultural improvement of hardwood stands.

We pushed ahead with our plans for research on environmental and urban forestry problems in the Northeast. These plans include research on: (1) the development and establishment of trees to improve the human environment; (2) the culture and maintenance of trees in densely populated areas; (3) the effect of trees on the amenities of the human environment—temperature, humidity, noise, and air pollution; and (4) the inter-relations of air pollution and tree diseases.

Our research in restoration of surface-mined land was strengthened by the cooperation of the West Virginia Surface Mine Association and the West Virginia Department of Natural Resources. Funds and other resources contributed by these two organizations provided for intensification of this work in West Virginia. William T. Plass transferred from our Berea, Kentucky, office to Princeton, West Virginia, to conduct this research.

At Delaware, Ohio, we replaced our research on hardwood plantation insects and oak wilt vectors with work on chemical controls of eastern forest insects; and at this same location, we started new research on virus diseases.

ASSISTANT DIRECTOR ASSIGNMENTS

To obtain a more equitable distribution of work and provide better management services to our research staff, we have revised the technical program assignments to Assistant Directors at the Station. Also, administrative services at our field offices were assigned to the Assistant Director for Research Support Services. The Assistant Directors and their assignments now are:

BEN A. ROACH.—Timber-management research work units at Orono, Me.; Parsons, W. Va.; Durham, N. H. (2); Warren, Pa.; Berea, Ky. (2); Columbus, Ohio; Burlington, Vt.; and Upper Darby, Pa.

KENNETH L. QUIGLEY.—Forest economics research units at Columbus, Ohio, and Upper Darby, Pa. Forest Survey unit at Upper Darby, Pa. Forest marketing research units at Princeton, W. Va. (4). Forest products utilization research units at Columbus, Ohio; Princeton, W. Va., and Upper Darby, Pa.

WARREN T. DOOLITTLE.—Forest watershed management research units at Durham, N. H.; Parsons, W. Va.; Syracuse, N. Y.; Berea, Ky.; Columbus, Ohio; and Upper Darby, Pa. Forest wildlife habitat management research units at Warren, Pa., and Morgantown, W. Va. Forest recreation research units at Durham, N. H., and Syracuse, N. Y. Forest engineering research unit at Morgantown, W. Va.

CARL E. SELISKAR.—Forest insect research units at Delaware, Ohio (4) and Hamden, Conn. (3). Forest disease research units at Delaware, Ohio (4); Hamden, Conn.; and Durham, N. H.

ROBERT BAIN.—Research support service units at Berea, Ky.; Burlington, Vt.; Columbus and Delaware, Ohio; Durham, N. H.; Hamden, Conn.; Morgantown, Parsons, and Princeton, W. Va.; Orono, Me.; Syracuse, N. Y.; and Warren and Upper Darby, Pa.

RESEARCH FACILITIES

Plans and site arrangements were completed for four new Station facilities. These are:

- Sugar Maple Research Laboratory at Burlington, Vermont, on land leased from the University of Vermont.
- Forest Sciences Laboratory at Berea, Kentucky, on land leased from Berea College.
- Forest Sciences Laboratory at Durham, New Hampshire, on land leased from the University of New Hampshire.
- Headquarters building for the Station and the Northern Area Office, State and Private Forestry, Forest Service, at Radnor, Pennsylvania, on purchased land.

We are ready to start construction on these buildings whenever funds become available. Meanwhile, construction of a major addition to our Forest Insect and Disease Research Laboratory at Delaware, Ohio, is progressing nicely; this facility is expected to be completed late in 1969.

SERVICE FUNCTIONS

In 1967 we initiated two new service activities: Information Services and Management Analysis. Both of these have matured rapidly and have begun paying handsome dividends.

Information Services releases about Station programs reached an estimated 30 million people during 1968. These releases were carried by newspapers, radio and TV stations, and popular periodicals; they generated 1,100 requests for our research papers. A few of the releases were carried by large metropolitan newspapers such as the *New York Times* and the *Philadelphia Bulletin*; and one received nationwide news service coverage.

The mission of Management Analysis is to improve management systems and reduce costs. This section has: (1) developed an improved, less costly method for scheduling, printing, and distributing our publications; (2) devised and installed a computerized property-record system; and (3) constructed and implemented a computerized workload analysis and measurement program.

PUBLICATIONS

in 1968 by staff members and cooperators of the Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture.

Berg, W. A., and W. G. Vogel.

1968. **Manganese toxicity of legumes seeded in Kentucky strip-mine spoils.** U. S. Forest Serv. Res. Paper NE-119, 12 pp.

Occurrence of manganese toxicity was studied on six legume species grown in 46 different acid strip-mine spoils from Kentucky. Toxicity was characterized by distinct paling (chlorosis) on the leaf margins, which was readily seen on young leaves of all species except Kobe lespedeza. Spoil pH was useful in predicting Mn toxicity on these legumes; water-soluble Mn extracted from the spoils was not.

Berry, Frederick H.

1968. **Spread of *Fomes annosus* root rot in thinned shortleaf pine plantations.** U. S. Forest Serv. Res. Note NE-87, 4 pp., illus.

Plots were established in thinned shortleaf pine plantations in Missouri to determine the rate of spread of *Fomes annosus* root rot over a 5-year period. On these plots mortality from *F. annosus* was about 5 trees per acre per year.

Black, Peter E., and Raymond E. Leonard.

1968. **The principle of watershed equilibrium.** Amer. Water Resources Assoc. Water Resources Bull. 4 (2): 49-50.

The watershed is described as a system in dynamic equilibrium. Factors making up the system are considered in terms of their stages of development.

Blevins, R. L., G. M. Aubertin, and N. Holowaychuk.

1968. **A technique for obtaining undisturbed soil samples by freezing *in situ*.** Soil Sci. Soc. Amer. Proc. 32: 741-742.

A freezing technique employing liquid nitrogen has been developed to freeze soil blocks *in place*. Frozen blocks of undisturbed soil can be transported to the laboratory and cut into desired-size blocks for studies of bulk density, moisture retention, and micromorphology.

Blum, Barton M.

1968. **Plastic tubing: A comparison of suspended vented and unvented installations.** Nat. Maple Syrup Dig. 7(3): 10-14, illus.

Unvented tubing produced 43 percent greater yields than vented tubing. The increase seems to be due to vacuum in the unvented tubing. (Same report is available in U. S. Forest Service Research Paper NE-79, 1967.)

Blum, Barton M., and Carter B. Gibbs.

1968. **Variation of sugar maple sap yield and its influence on experimental design.** U. S. Forest Serv. Res. Paper NE-108, 8 pp.

The variation in sap yield from sugar maple trees precludes efficient use of simple random-sampling designs. Grouping of trees into blocks or pairs on the basis of previous sap yield will reduce the number of samples needed for tests of treatment effects. Pairing or grouping of tapholes on the same tree is also a satisfactory procedure for studies involving taphole treatments.

Blum, Barton M., and Melvin R. Koelling.

1968. **Vacuum pumping increases sap yields from sugar maple trees.** U. S. Forest Serv. Res. Paper NE-106, 14 pp., illus.

An individual-tree study demonstrated that vacuum pumping increases sap yield and that the increased sap volume is drawn from the tree. A large-scale study (171 trees) indicated a 385-percent increase in sap yield due to vacuum pumping alone. Data and observations on temperature and weather relations.

Blum, Barton M., and Melvin R. Koelling.

1968. **Effect of vacuum pumping on lateral movement of sap in the maple tree bole.** U. S. Forest Serv. Res. Paper NE-107, 9 pp., illus.

A study of possible experimental bias due to lateral sap movement between paired tapholes when one was vacuum-pumped. No movement of dyed sap nor diminishing of positive natural sap pressure was observed between tapholes paired 6 inches apart on the tree bole, suggesting that lateral movement of sap between tapholes did not occur.

Bjorkbom, John C.

1968. **Planting paper birch in old fields in Maine.** U. S. Forest Serv. Res. Paper NE-103, 12 pp., illus.

After five growing seasons, survival and height growth were better where the sod was removed than where the seedlings were planted directly in the sod. Meadow mice caused much mortality and damage. Deer browsed many of the seedlings. The results suggest that paper birch plantations could be successfully established on suitable old-field sites.

Bjorkbom, John C., and Robert M. Frank.

1968. **Slash burning and whole-tree skidding fail to provide mineral-soil seedbeds for spruce-fir.** N. Logger 16(7): 20, 45.

A study in Maine showed that burning clearcut areas for exposing mineral soil does not seem feasible in the spruce-fir type. The humus layer is usually too compact and too moist for a complete burn.

Bormann, F. H., G. E. Likens, D. W. Fisher, and R. S. Pierce.

1968. **Nutrient loss accelerated by clearcutting of a forest ecosystem.** Sci. 159: 882-884, illus.

The forest of a small watershed-ecosystem was cut to determine how removal of vegetation affects nutrient cycles. Relative to undisturbed ecosystems, the cut ecosystem exhibited accelerated loss of nutrients. Possible causes of the pattern of nutrient loss from the cut ecosystem are discussed.

Bormann, F. H., G. E. Likens, D. W. Fisher, and R. S. Pierce.

1968. **Nutrient loss accelerated by clearcutting of a forest ecosystem.** *In* Symposium on Primary Productivity and Mineral Cycling in Natural Ecosystems. Ecol. Soc. Amer. and Amer. Assoc. Adv. Sci.: 187-196.

The forest of a small watershed-ecosystem was cut to determine the effects of removal of vegetation on nutrient cycles. Relative to undisturbed ecosystems, the cut ecosystem exhibited accelerated loss of nutrients. Possible causes of the pattern of nutrient loss from the cut ecosystem are discussed.

Boyce, Stephen G., and Roswell D. Carpenter.

1968. **Provisional grade specifications for hardwood growing-stock trees.** U. S. Forest Serv. Res. Paper NE-97, 12 pp.

Specifications for selecting young trees with the potential of producing veneer

logs or grade-1 sawlogs, and probabilities for predicting the grades that all young trees in the stand will attain if they are retained until they reach maturity. Four grading factors related to tree form are evaluated.

Brackley, Allen M., and David W. Taber.

1968. **A structural plywood industry for the Northeast.** N. Logger 17(4): 18, 19, 48-50, illus.

Conditions seem favorable for a structural plywood industry in the Northeast. The raw-material resource is adequate, a potential market exists, and current production operations do not reveal critical technical problems.

Burns, Denver, P., and Lester P. Gibson.

1968. **The leaf-mining weevil of yellow-poplar.** Can. Entomol. 100: 421-429, illus.

The known distribution, biology, and life cycle of the yellow-poplar leaf-mining weevil *Odontopus calceatus* (Say); illustrates the mature larva, larval head capsule, and pupa, and the damage done to the leaves of yellow-poplar.

Campbell, Robert W.

1968. **Measuring age specific mortality factors of the gypsy moth.** Entomol. Soc. Amer. N. Cent. Br. Proc. 1967: 53-56.

A discussion of methods for estimating each of three different sorts of mortality factors within certain age intervals in the gypsy moth population system. The mortality factors are: mortality caused by ichneumonids among dense populations of pupae; predation by vertebrates among sparse populations of instar IV through VI larvae and pupae; and the components of disease among dense populations of large larvae.

Campbell, Robert W.

1968. **The ecology of insect population in theory and practice.** (Review). Forest Sci. 14: 351.

A review of the book "The ecology of insect population in theory and practice," by L. R. Clark, P. W. Geier, R. D. Hughes and R. F. Morris. (Published by Barnes and Noble, New York; and Methuen, London, 1967.) The book deals with the nature of the processes that determine the number of insects in a population, from points of view ranging from the purely theoretical to the completely utilitarian.

Carlson, T. C.

1968. **Estimating hourly production of sliced wood.** Forest Prod. J. 18(11): 45-49, illus.

This paper offers a theoretical basis for making production decisions at one station in a wood-slicing operation—the slicer. Simple equations help clarify how four production variables influence input and output at the slicer. Without interrupting the operation, a production manager may use these equations to implement several aspects of production planning and control.

Carroll, W. J., and W. E. Waters.

1967. **Eastern hemlock looper *Lambdina fiscellaria fiscellaria* (Guen.) *In* Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 120-122, illus.

A brief description ot the distribution, hosts, damage, life history, and control of the eastern hemlock looper *Lambdina fiscellaria fiscellaria* (Guen.).

Cromer, Jack I., and H. Clay Smith.

1968. **Sufficient deer browse produced by a wide range of cutting practices.** NE Fish & Wildlife Conf. Trans. 25: 25-33, illus.

A deer browse study in Appalachian hardwoods showed that any type of economical timber harvest produced more than enough stems of preferred species to support a population of 13 deer per square mile. Thus the need for producing deer browse is not of vital importance to timber managers in this area, and cutting practices can be oriented to other objectives.

Czapowskyj, Miroslaw M., John P. Mikulecky, and Edward A. Sowa.

1968. **Response of crownvetch planted on anthracite breaker refuse.** U. S. Forest Serv. Res. Note NE-78, 7 pp., illus.

Lime applications were essential to establishment of crownvetch (*Coronilla varia* L.) on coal breaker refuse in the Pennsylvania Anthracite Region, and mulch treatments were highly beneficial. Fertilizer applications had only slight effect on either establishment or growth.

Dale, Martin E.

1968. **Growth response from thinning young even-aged white oak stands.** U. S. Forest Serv. Res. Paper NE-112, 19 pp., illus.

Two young white oak stands about 30 years of age, one in southeastern Iowa, one in eastern Kentucky, responded similarly to various levels of thinning. Gross basal-area growth and cubic-volume growth were little affected within the range of stocking from 50 percent to maximum stocking, although volume growth was slightly more in Kentucky because the site was better. Maximum net basal-area growth occurred between 50 to 60 percent of normal stocking and amounted to about 3.0 square feet per acre per year for both stands.

Davidson, Walter H., and David H. Dawson.

1968. **Trees and shrubs for roadside beautification.** Dakota Farmer, 6 April 1968: 33-35, illus.

Guidelines for establishing beautification plantings in the Northern Plains. Both roadside plantings and screen plantings are discussed. A list of recommended tree and shrub species is given, and planting designs, establishment techniques, and maintenance practices are described.

Davidson, A. G., and M. E. Fowler.

1967. **Scab and black canker of willow, *Pollaccia saliciperda* (All. and Tub.) Arx (Syn: *Fusicladium saliciperdum* (All. and Tub.) Tub.) and *Physalospora miyabeana* Fukushi.** *In* **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 201-203, illus.

A brief description of the distribution, hosts, damage, life history, and control of scab and black canker of willow *Pollaccia saliciperda* (All. and Tub.) Arx (Syn: *Fusicladium saliciperdum* (All. and Tub.) Tub.) and *Physalospora miyabeana* Fukushi.

Davis, Grant, and Walter H. Davidson.

1968. **Coal-mine spoil banks offer good potential for timber and wildlife production.** Pa. Forests 58: 20-21, illus.

Strip-mined land is often better suited for growing timber products than is generally recognized. On favorable spoil sites, plantations that are properly managed for timber production should produce pulpwood in 20 to 25 years and sawlogs in 30 to 40 years. Strip-mining also is generally beneficial to wildlife production.

Dempsey, Gilbert P.

1968. **Some new guidelines for the forest cooperative.** J. Forestry 66: 17-21, illus.

Many of the forest cooperatives tried in the United States in the past 50 years have failed. After thorough study and analysis of all available records, the author concludes that even many of those that failed had nevertheless served their purpose. Operational problems are defined, and causes of failure are pinpointed: an inadequate forest resource base to work with; lack of support by members; weak management; and inadequate capital.

Dochinger, Leon S.

1968. **Chlorotic dwarf in eastern white pine.** U. S. Forest Serv. NE. Area Nurserymen's Conf. Proc. 1967: 1-5.

The symptoms and cause of the chlorotic dwarf disease of eastern white pine (*Pinus strobus* L.), with recommendations for control.

Dochinger, L. S.

1968. **The impact of air pollution on eastern white pine: the chlorotic dwarf disease.** (Abstr.) J. Air Pollut. Contr. Assoc. Proc. Dig. 61:189.

Investigations into the chlorotic dwarf problem were to define its symptomatology and etiology and to develop measures for control. By controlling the atmospheres around chlorotic dwarf field trees, evidence was obtained that proved that chlorotic dwarf is effected by the injury of gaseous dispersoids on the foliage of susceptible individuals. The best long-run solution probably lies in breeding resistant trees.

Dochinger, Leon S.

1968. **The impact of air pollution on eastern white pine: the chlorotic dwarf disease.** J. Air Pollut. Contr. Assoc. 18: 814-816, illus.

A discussion of the symptomatology, etiology, and control of chlorotic dwarf disease of eastern white pine. By controlling the atmospheres around chlorotic dwarf field trees, evidence was obtained to prove that chlorotic dwarf is effected by gaseous dispersoids on the foliage of susceptible individuals. In the long run the best solution for controlling chlorotic dwarf probably lies in breeding resistant trees.

Dochinger, L. S.

1968. **Chlorotic dwarf of eastern white pine: symptoms, etiology, and control.** (Abstr.) Phytopathol. 58: 1048.

A brief account of the symptomatology and etiology of chlorotic dwarf in eastern white pine.

Donley, D. E., and D. P. Burns.

1968. **Factors regulating populations of the tuliptree scale.** (Abstr.) Bull. Entomol. Soc. Amer. 14(3): 211.

Population levels of the tuliptree scale infesting *Liriodendron tulipifera* L. have been studied for 8 years. Populations are lowered by insect predators and parasites whose activities complement each other. Survival is enhanced by ants that actively or passively protect the scales through their food gathering behavior.

Dubois, Normand R.

1968. **Laboratory batch production of *Bacillus thuringiensis* spores and crystals.** Appl. Microbiol. 16: 1098-1099.

A description of a procedure whereby small batches of clean spores and crystals

of *Bacillus thuringiensis* can easily and quickly be produced in one liquid medium supporting growth, sporulation, and lysis of the sporangium within a 40-hour incubation period.

Echelberger, Herbert E., and Elwood L. Shafer, Jr.
1968. **Some managers' viewpoints on campers and campground operation.** U. S. Forest Serv. Res. Note NE-88, 6 pp., illus.
Nine managers of public campgrounds comment on their relations with their campers and some of the management problems they have. Topics include camping fees, reactions to survey interviews, registration procedures, campers' pets, and maintenance of facilities.

Eschner, A. R., and R. E. Leonard.
1968. **Disposition of intercepted snow.** East. Snow Conf. Proc. 25: 73-81.
A study of the amount of snow intercepted by the crowns of coniferous trees illustrates the disposition of snow under the climatic conditions of central New York and indicates some of the problems involved in determining snow-evaporation losses to the various factors that affect it, such as temperature, humidity, and solar radiation.

Federer, C. A.
1968. **Spatial variation of net radiation, albedo, and surface temperature of forests.** J. Appl. Meteorol. 7: 789-795.
An evaluation of the spatial variations in net radiation over short distances in a uniform forest stand and over nearby associated cover types. Included are methods of obtaining data and detailed site descriptions.

Federer, C. A.
1968. **Radiation and snowmelt on a clearcut watershed.** East. Snow Conf. Proc. 25: 28-42.
Daily snowmelt on a clearcut watershed in central New Hampshire was estimated by using the energy balance. In melt periods, net solar radiation provided sufficient energy for melt and a small amount of evaporation; heat gain by convection was about equal to loss by net longwave radiation. Great spatial variation in slash density caused corresponding variation in net radiation and snowmelt.

'erguson, Roland H.
1968. **The timber resources of Pennsylvania.** U. S. Forest Serv. Resource Bull. NE-8, 147 pp., illus.
A report on a resurvey 10 years after the initial survey made by the U. S. Forest Service. Statistical findings on forest-land area, timber volume, annual growth, and timber cut, based upon remeasured 1/5-acre plots and new 10-point cluster plots. Reports timber products output by forest industries, based upon a canvass in 1965, and changes and trends in the timber resource. Presents an outlook on the timber supply and management opportunities. Includes 93 tables of statistical data for the entire State.

Filip, S. M., and N. D. Shirley.
1968. **Cost of site preparation with a tractor rake in northern hardwood clearcutting.** N. Logger 17(5): 18-19, illus.
A tractor with rock rake does an adequate job of mixing mineral soil with humus for birch regeneration in New England. The process avoids problems caused by bulldozer blades at about the same cost. Method of operation, and cost and time figures are discussed.

Filip, S. M., and F. W. Williams.

1968. **Volume and value of products harvested from a northern hardwood clearcutting.** N. Logger 17(4): 22-23.

A detailed description of the volume and value of products harvested from clearcutting of a mature stand of northern hardwoods. Stand description, yield estimates, logging methods, actual yield, and delivered value are given.

Finnegan, R. J., and P. A. Godwin.

1967. **Northern pine weevil *Pissodes approximatus* Hopk.** *In* Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico. Can. Dep. Forestry and Rural Develop. Pub. 1180: 145-147, illus.

A brief description of the distribution, hosts, damage, life history, and control of northern pine weevil *Pissodes approximatus* Hopk.

Frank, Robert M.

1968. **Clearcutting in spruce-fir: today and tomorrow.** Soc. Amer. Foresters New England Sect. Proc. 1968: 28-35.

A discussion of the present and future of clearcutting Maine spruce-fir forests for wood fiber production. Silvicultural treatments are described; predictions for even-aged management and mechanization are made.

Frayer, Warren E.

1968. **Snoop: A computer program for 2- and 3-dimensional plotting.** U. S. Forest Serv. Res. Paper NE-91, 24 pp., illus.

A computer program called SNOOP, described in detail, allows visual examination of the interaction effects of independent variables by way of three-dimensional plotting. Two-dimensional plotting is also available. The program is written in FORTRAN IV and should run with little or no modification on computers that accept FORTRAN IV, have a 32K core, and have three tape drives or equivalent input/output devices.

Frayer, Warren E.

1968. **A computer program for making S-contrasts involving linear combinations of group means.** U. S. Forest Serv. Res. Note NE-80, 6 pp.

A description of a FORTRAN IV computer program that is used for making Scheffé's S-contrasts in one-way analyses.

Frayer, Warren E., Robert W. Wilson, Robert C. Peters, and C. Allen Bickford.

1968. **FINSYS: An efficient data-processing system for large forest inventories.** J. Forestry 66: 902-905, illus.

A general description of a data-processing system designed for large forest inventories. The system, developed at the Northeastern Forest Experiment Station, has undergone testing and review and is now in use at several locations throughout the United States.

Gabriel, William J.

1968. **Dichogamy in *Acer saccharum*.** Bot. Gaz. 129: 334-338.

A study of dichogamy in sugar maple (*Acer saccharum* Marsh) has shown that both protandry and protogyny occur in this species. Synchronization of blooming periods of flowers of opposite sexes resulted in reciprocal pollination between trees with different dichogamous conditions. Dichogamy was complete in protandrous trees; abnormal temperatures appeared to have little effect on the timing and duration of antheses. On protogynous trees, the expression of dichogamy appeared to be related to temperature.

Gabriel, W. J., and E. E. Howe.

1968. **Practical problems of a sugar maple selection program.** NEFTIC Proc. 15: 72-74.

A report of important problems encountered and how they were overcome in a program to select sugar maples for high sugar content in sap for use as parent stock and as sources of clonal material.

Galford, Jimmy R., and John W. Peacock.

1968. **Combined laboratory and greenhouse techniques for year-round rearing of the mimosa webworm, *Homadaula anisocentra*.** Ann. Entomol. Soc. Amer. 61: 919-920.

During summer, field-collected larvae were reared to the pupal stage on a semisynthetic artificial diet. The pupae obtained by this method were held at 5°C. until required. During winter, larvae were reared in the greenhouse on potted honey locust seedlings.

Gansner, David A.

1968. **The timber resources of Kentucky.** U. S. Forest Serv. Resource Bull. NE-9, 97 pp., illus.

A report on a resurvey 14 years after the initial forest survey made by the U. S. Forest Service, presenting statistical findings on forest-land area, timber volume, net annual growth, and timber cut, and describing changes and trends in the timber resource. Report contains 45 tables of statistical data.

Gatchell, Charles J.

1968. **Machine-driving of wooden posts.** Highway Res. Rec. 222: 89-98.

Trials of a recently developed post-driving machine on a variety of sites along a West Virginia highway demonstrated that wooden posts can be installed at rates competitive with driven steel posts, and at less cost. (A reprinting of U. S. Forest Serv. Res. Paper NE-81, 1967.)

Gibbs, Carter B.

1968. **Results of tubing research by the U. S. Forest Service.** Seventh Conf. on Maple Prod. Proc.: 6-7.

A brief description of the research done in Vermont on use of plastic tubing for collecting sugar maple sap. Vented and unvented systems—both aerial and ground lines—were compared. Use of vacuum pumping on unvented lines increased seasonal yields more than 300 percent over yields from vented gravity-flow lines.

Gibson, L. P.

1968. **Distribution of *Curculio* species in the new world.** (Abstr.) Bull. Entomol. Soc. Amer. 14(3): 211.

The known distribution of all *Curculio* species is presented for Canada, the United States, Mexico, and Central America. The relationship of this distribution to the distribution of the primary and secondary host plants is discussed.

Gibson, Lester P.

1968. **The 1958 pine tip moth collapse in Ohio.** Ann. Entomol. Soc. Amer. 61: 786-787.

The virtual disappearance of pine tip moth populations, *Rhyacionia frustrana* (Comstock) and *R. rigidana* (Fern.), in Ohio 1958 may be due to a freezing rain in February 1958, which broke infested pine tips off or open, allowing moisture to enter ruptured cells and kill the pupae.

Gochenour, Donald L., Jr., and R. L. Hartman

1968. **Factors affecting logging operations in hardwood forests.** N. Logger 17(3): 20, 22, 38, illus.

Discusses factors affecting logging with wheeled skidders in the Appalachian hardwood forest. Manual and nonmanual (tractor) operations are analyzed. Wheeled skidders operating from adequate skid roads performed satisfactorily on steep and moderately steep slopes.

Gochenour, Donald L. Jr., and R. L. Hartman.

1968. **How wheeled skidders work on 40 percent hardward slopes.** Can. Forest Ind. 88(7): 26-29, illus.

A study of wheeled skidder productivity on steep hardwood slopes (20 to 40 percent) showed that the degree of slope seems to have little effect on skidder roundtrip travel times. Skidder performance, manual operations of skidding, and distance rates are discussed.

Godwin, P. A., and W. A. Reeks.

1967. **White-pine weevil *Pissodes strobi* (Peck).** *In* Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico. Can. Dep. Forestry and Rural Develop. Pub. 1180: 148-151, illus.

A brief description of the distribution, damage, hosts, life history, and control of the white-pine weevil *Pissodes strobi* (Peck).

Graber, Raymond E.

1968. **Planting site, shade, and local seed source: Their effects on the emergence and survival of eastern white pine seedlings.** U. S. Forest serv. Res. Paper NE-94, 12 pp., illus.

Local seed source had no apparent effect either on seedling emergence or on seedling survival. Heavy shade favorably modified the environment on a dry site, greatly increasing emergence, but light shade gave slightly better results on a moist site. Seedling survivals during the first growing season were about equal among sites and treatments, but amounts of mortality due to different causes were directly related to planting site and shade intensity.

Gregory, G. F.

1968. ***Ceratocystis fagacearum* distribution within bur and red oak seedlings.** (Abstr.) Phytopathol. 58: 399.

A report on a study undertaken to determine the location of the oak wilt pathogen within red and bur oak trees during pathogenesis. Uniform greenhouse-grown 1- to 2-year-old trees were inoculated with 2 ml. of spore suspension of a single spore isolate of the pathogen.

Grisez, Ted J.

1968. **Growth & development of older plantations in northwestern Pennsylvania.** U. S. Forest Serv. Res. Paper NE-104, 40 pp., illus.

Plantations examined in 1939 were re-examined in 1960-61, and sample plots were laid out to obtain data on yield. Red pine and the larches still rated best, but pitch pine and jack pine could no longer be recommended. White pine looked better than it did in 1939, and Norway spruce was still growing well. However, Scotch pine could be recommended only in certain situations. Mixed plantations merit consideration.

Hanks, Leland F., and Carl W. Swanson.

1967. **Lumber grade yields from paper birch and balsam poplar logs in the Susitna River Valley, Alaska.** USDA Forest Serv. Res. Paper PNW-51, 30 pp., illus. Inst. N. Forestry, PNW Forest and Range Exp. Sta., Juneau, Alaska.

A study was conducted at Wasilla, Alaska, in 1964 to determine the lumber-grade recovery from paper birch and balsam poplar logs. Actual recoveries are summarized by scaling diameter for each of the three Forest Service log grades. This information, along with pertinent lumber prices, may be used to estimate the value of lumber to be sawed from birch and poplar logs in Alaska.

Hansen, Bruce G.

1968. **Christmas tree marketing, a bibliography.** Amer. Christmas Tree J. 12(2): 33-36.

A list of recently published information about Christmas tree production and marketing, supplementing a bibliography published in May 1967 by the National Christmas Tree Growers' Association.

Hart, Arthur C., Herschel G. Abbott, Edward R. Ladd.

1968. **Do small mammals and birds affect reproduction of spruce and fir?** U. S. Forest Serv. Res. Paper NE-110, 8 pp., illus.

Many spruce-fir stands in the Northeast reproduce to fir rather than spruce: small mammal preferences for spruce seed have been suggested as one reason for this. A study of spruce-fir reproduction, using various combinations of protection from small mammals and ground-feeding birds, showed no evidence of preferential feeding.

Hay, C. John.

1968. **Frass of some wood-boring insects in living oak (Coleoptera: Cerambycidae; Lepidoptera: Cossidae and Aegeriidae).** Ann. Entomol. Soc. Amer. 61: 255-258, illus.

Hand-lens descriptions of extruded dry frass are given for five wood-boring insects that attack living black, scarlet, and red oaks: the red oak borer, the living-beech borer, a clear-winged moth, the carpenterworm, and the little carpenterworm. The two constituents of frass—excrement pellets and wood pieces—are described according to shape, length, color, and solidity.

Healy, W. M.

1968. **Forage preference determination through use of tame deer.** NE. Fish & Wildlife Conf. Proc. 25: 35-39. Bedford, N. H.

Three deer were trained to forage while restrained by a 20-foot rope. Time spent in foraging was recorded by species and plant part. Deer fed most actively during the first hour of 1- to 7-hour periods. The technique revealed foraging that could not be observed in other procedures. Technique limitations were small sample size, cost in time and equipment, deer-behavior changes, and risk of losing valuable trained deer.

Herrick, Owen W., and J. Edwin Morse.

1968. **Investment analyses of stand improvement and reforestation opportunities in Appalachian forests.** U. S. Forest Serv. Res. Paper NE-111, 43 pp., illus.

A study of investment potential for the most common timber-stand-improvement and stand-conversion opportunities on the George Washington National Forest, providing a basis for rating and comparing investment

opportunities, indicating what kind of projects to favor in planning a stand-treatment program.

Holt, William R.

1968. **A further note on sample size for chi-square test: The r x c table.** J. Econ. Entomol. 61: 853-854.

A formula is derived that can be used to estimate the size of the sample needed for r x c tables when preliminary data are available. The estimate of the sample size detects proportionate differences of the magnitude appearing in the preliminary sample. An example illustrates the use of the formula for hypothetical experiments to evaluate an insecticide.

Hornbeck, J. W.

1968. **Protecting water quality during and after clearcutting.** J. Soil & Water Conserv. 23(1): 19-20, illus.

Experiments show that small forest areas in steep terrain can be clearcut without serious erosion and damage to water quality if the logging operation is carefully planned and conducted.

Hoyle, M. C.

1968. **Growth and nutrient composition of yellow birch in split-medium cultures.** Agron. Abstr.: 136.

Yellow birch develops a shallow root system in podzol soils in New England. It was hypothesized that this condition resulted from subsoil nutrient deficiencies. Split-medium cultures were used to test the hypothesis. Nutrient-adequate forest humus was used for the upper medium, and variously altered nutrient solutions were used for the lower medium. The results showed that a lower substrate deficient in Ca will not support primary root development of yellow birch. Tissue nutrient analyses disclosed several instances of complex nutrient interactions.

Huntzinger, Harold J.

1968. **Methods for handling black cherry seed.** U. S. Forest Serv. Res. Paper NE-102, 22 pp.

In the first study, seed cleaned of pulp, kept moist, and stratified for a long period gave high rates of germination under all stratification methods used. In the second, fresh seed needed a period of warm temperature to after-ripen before moist-cold stratification. In the third, cold storage of seed was found to be much better than warm storage over a 15-month study period.

Jensen, Keith F.

1967. **Measuring oxygen and carbon dioxide in red oak trees.** U. S. Forest Serv. Res. Note NE-74, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A method is described for collecting gas samples from tree trunks by placing a permanent probe in the tree and withdrawing samples with a portable vacuum pump. Marked quantitative differences were found between the concentration of gases in tree trunks and the concentration of gases in the atmosphere.

Johnson, Noye M., Gene E. Likens, F. H. Bormann, and Robert S. Pierce.

1968. **Rate of chemical weathering of silicate minerals in New Hampshire.** Geochimica et Cosmochimica Acta 32: 531-545, illus.

The losses of dissolved Ca, Na, Mg, and K have been determined for six small watersheds in New Hampshire during the period 1963-67. From the rate at which Ca and Na are lost, the steady-state chemical weathering rate is calculated

at 800 kg. of bedrock-till per hectare per year. Under podzol weathering conditions, a major part of the K and Mg released by the breakdown of primary minerals is apparently retained in pedogenic clays.

(Jones, Clark.)
1968. **Who's the the sweetest of them all?** N. Y. Times Feb. 11 (Sect. 2): D.31.
In cooperation with state organizations in the Northeast, Forest Service scientists at the Northeastern Forest Experiment Station's Burlington, Vt., unit are trying to develop genetically superior (sweeter) sugar maples and to find ways to propagate them successfully.

Jordan, James S.
1968. **Influence of diet in lead poisoning in waterfowl.** Trans. NE. Fish and Wildlife Conf. 25: 143-170.
Controlled experiments with Pekin ducks, captive wild mallards, game-farm mallards, lesser scaup, and Canada geese showed that diet was the most important variable modifying the effects of ingested shot pellets. Symptoms of lead poisoning did not appear in birds that maintained a normal or nearly normal rate of food intake.

Kingsley, Neal P.
1968. **Pulpwood production in the Northeast—1966.** U. S. Forest Serv. Resource Bull. NE-11, 33 pp., illus.
A report on the fourth annual canvass of pulpwood production in the 14 Northeastern States, containing data on round pulpwood, pulpwood chips, and wood-industry residue production; and on receipts in region, by state. Round pulpwood production is reported by states, counties, and species groups; pulpwood chips and residues are reported by states for softwoods and hardwoods. Comparisons are made with the previous year's production and the trend in pulpwood production in the Northeast for the past 4 years is shown graphically.

Kingsley, Neal P., and Joseph E. Barnard.
1968. **The timber resources of Vermont.** U. S. Forest Serv. Resource Bull. NE-12, 117 pp., illus.
A report on a resurvey 18 years after the initial forest survey made by the U. S. Forest Service, presenting statistical findings on forest-land area, timber volume, net annual growth, and timber cut, and describing changes and trends in the timber resource. The report also contains a discussion of the timber supply outlook and opportunities for timber management. Report contains 72 tables of statistical data, including forest areas and timber volume for counties.

Kingsley, Neal P., and David R. Dickson.
1968. **Timber products production in West Virginia—1965.** U. S. Forest Serv. Resource Bull. NE-10, 52 pp., illus.
A report on a canvass of timber products producers in West Virginia. Tables show production, value, and other pertinent data for the major timber products produced. Data are compiled by species and by counties wherever possible.

Koelling, Melvin R.
1968. **Sap yields from fall and spring tapping of sugar maple.** U. S. Forest Serv. Res. Paper NE-115, 8 pp., illus.
Fall sap production was approximately one-third that obtained from similar trees in the normal spring season. Sugar concentrations were about two-thirds that of normal season sap. Fall tapping significantly reduced normal yields from

trees re-tapped the following spring. Spring sap yields from fall-tapped trees were approximately two-thirds of the spring yield from similar trees not fall-tapped. The total yield (fall plus spring) of fall-tapped trees was about equal to the spring yield of trees tapped only in the spring.

Koelling, Melvin R.

1968. **Rooting ability of sugar maple cuttings depends on date of collection in each region.** USDA Forest Serv. Tree Planters' Notes 19: 20-22, illus.

Results of this study and other experience indicate that the physiological conditions conducive to maximum root formation are present in the twigs of a tree for only a brief time. The most favorable date for collecting cuttings would vary from region to region, depending on the state of development of the twigs.

Koelling, Melvin R.

1968. **Determining sap sweetness in small sugar maple trees.** U. S. Forest Serv. Res. Note NE-76, 4 pp., illus.

A technique based on the use of a hypodermic needle for determining sap-sugar concentrations in small trees is applicable to pot cultures in greenhouses and also, with the use of a movable shelter, to seedlings in nursery beds.

Koelling, Melvin R., Barton M. Blum, and Carter B. Gibbs.

1968. **A summary and evaluation of research on the use of plastic tubing in maple sap production.** U. S. Forest Serv. Res. Paper NE-116, 12 pp.

This summary of research results includes comparisons of vented and unvented tubing lines, the use of vacuum pumping, and a discussion of the advantages and disadvantages of several methods of installing tubing. Major findings indicate that: (1) unvented lines increase yields up to 40 percent over vented lines when installed in an aerial system, and (2) that yield increases of over 300 percent are possible when artificial vacuum is applied to unvented lines.

Koelling, M. R., B. M. Blum, and C. B. Gibbs.

1968. **Fall sap-sugar percentages—a guide for cultural operations in the sugarbush.** N. Logger 16(10): 24, 26, illus.

Percentage of sap-sugar in maple trees in the fall was found to be closely related to that in the spring, although the values were generally higher in the spring than in the fall. Therefore fall sap-sugar percentages may be used with considerable confidence as indicators of production potential, and they may serve as guides for thinning trees in a sugar bush.

Koenick, Leonard J., and E. George Stern.

1968. **Load-carrying capacity of short flooring strips.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 75, 8 pp.

A report on a study to determine the load-carrying capacity of short pieces of standard 25/32 by 2 1/4-inch tongue-and-groove oak strip flooring acting as load-sharing members. Short flooring strips can safely support such concentrated loads as are found in residences even if the strips are not directly supported by sleepers or joists.

Krochmal, Arnold.

1968. **Papaya diseases of tropical America.** World Crops June 1968: 40-41, illus.

The principal diseases of papaya in tropical America include two fungus diseases, anthracnose and decline, and two virus diseases, bunchy top and mosaic.

Krochmal, Arnold.

1968. **Medicinal plants and Appalachia.** Econ. Bot. 22(4): 332-337, illus.

A survey of the status of commercial medicinal plants in Appalachia. Market conditions and research programs are discussed briefly, and 125 commercially demanded medicinal plant species are listed.

Krochmal, Arnold, and George Samuels.

1968. **Deficiency symptoms in nutrient pot experiments with Cassava.** CEIBA 14(1): 7-15.

Cassava (*Manihot utilissima* Pohl) was grown in sand culture using nutrient solutions to develop deficiencies of nitrogen, phosphorus, potassium, magnesium, calcium, sulfur, iron, manganese, and boron. Both height and weight of plant were severely reduced when nitrogen was omitted. The leaf was highest in nitrogen; the stem highest in phosphorus and potassium; the petiole highest in calcium and magnesium. Visual deficiency symptoms are described.

Lane, Richard D.

1968. **Forest Service reclamation research.** Mining Congr. J. 54(5): 38-42, illus.

The U. S. Forest Service has selected four broad areas for reclamation research: engineering, hydrology, soil science, and revegetation. More than 60 studies have been started, and this research has already helped to improve reclamation practices throughout the eastern coal fields. The most difficult and important research task ahead is to develop a new technology for mining in mountain areas.

Lane, Richard.

1968. (**Strip mining.**) Natl. Inst. on Nat. Resources Law Proc.: 37-39. (Frankfort, Ky.)

The research being done in strip mining by the U. S. Forest Service is an example of efforts by the scientific community to provide some of the knowledge needed to develop sound conservation laws for strip-mining.

LaPage, Wilbur F.

1968. **The role of customer satisfaction in managing commercial campgrounds.** U. S. Forest Serv. Res. Paper NE-105, 23 pp., illus.

The key to a successful private campground is satisfied customers. A series of studies at New Hampshire's state parks and commercial campgrounds suggests several ways in which the campground manager can increase camper satisfaction and thus promote longer and more frequent visits.

LaPage, Wilbur F.

1968. **The role of fees in campers' decisions.** U. S. Forest Serv. Res. Paper NE-118, 24 pp., illus.

How fees influence campers' decisions of where, when, and how much to camp is examined from a cross-section of 1967 campers at New Hampshire state parks. Size of camping fees and method of charging fees both influence the frequency of camping and the selection of campgrounds.

LaPage, W. F.

1968. **Some implications of recreation markets for rural economies.** (Abstr.) Sociological Abstracts 16(7) Suppl. 2: 67, 70.

Advantages of considering the market aspects of outdoor recreation in general and camping in particular. A family of recreation market models is presented, and the concept of a market area is modified for use in outdoor recreational analysis on the basis of substitutability among recreation destinations.

Leak, William B.

1968. **Birch regeneration: a stochastic model.** U. S. Forest Serv. Res. Note NE-85, 7 pp.

The regeneration of a clearcutting with paper or yellow birch is expressed as an elementary stochastic (probabalistic) model that is computationally similar to an absorbing Markov chain. In the general case, the model contains 29 states beginning with the development of a flower (ament) and terminating with the abortion of a flower or seed, or the development of an acceptable stem, unacceptable stem, dead seedling, or nongerminate (the six absorbing states).

Leak, William B., Stanley M. Filip, and Dale S. Solomon.

1968. **Rates of value increase for yellow birch in New England.** U. S. Forest Serv. Res. Paper NE-120, 10 pp.

Compound interest rates of value increase, over a 10-year period, were computed for yellow birch for a range in vigor class (growth rate), veneer-log and sawlog grades, merchantable height, and d.b.h. An improvement in log grade over the period resulted in moderate to high compound interest rates. Otherwise rates were low. Recommendations on tree marking and choice of optimum harvest size are given, based on grade-improvement potentials.

Leonard, Raymond E., and Arthur R. Eschner.

1968. **A treetop tramway system for meteorological studies.** U. S. Forest Serv. Res. Paper NE-92, 10 pp., illus.

A system of tramways was built between several towers so that meteorological instruments could be passed above the forest canopy to measure spatial variation in reflected short-wave radiation. The system has operated well under all weather conditions for over a year. Construction details for the tramway system are described.

Leonard, Raymond E., and Arthur R. Eschner.

1968. **Albedo of intercepted snow.** Water Resources Res. 4(5): 931-935, illus.

Incident and reflected shortwave radiation above a red pine plantation were measured at 30-minute intervals for 2 days after a 12-inch snowfall. Maximum albedo was less than 20 percent of incident radiation—much lower than the 70 to 90 percent observed for fresh snow on the ground and assumed to apply to intercepted snow. Thus energy available for evaporation of intercepted snow may be four times greater than previously supposed.

Lewis, F. B., and L. Daviault.

1967. **Gypsy moth *Porthetria dispar* (L.).** *In* **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 152-156, illus.

A brief description of the distribution, hosts, damage, life history, and control of the gypsy moth *Porthetria dispar* (L.).

Lincoln, A. Charles.

1968. **Insect research at the Delaware laboratory.** Trees Mag. 28(2): 14-17, illus.

A summary of an illustrated talk to arborists about studies being conducted in the three insect research projects at Delaware, Ohio. The value of shade trees in the United States is placed at $30 billion, and Americans are estimated to spend $37 million annually protecting 200 million shade trees from insect damage alone. Examples are used to dramatize the types of research being conducted.

Little, Silas, John J. Mohr, and Paul V. Mook.

1968. **Ten-year effects from row thinnings in loblolly pine plantations of eastern Maryland.** U. S. Forest Serv. Res. Note NE-77, 8 pp.

Four degrees of row thinning were tested in 17-year-old loblolly pine plantations

of eastern Maryland. In the following 10 years diameter and basal-area growth of tagged trees increased in relation to intensity of thinning. The heavier thinnings also had the most effect in increasing live-crown lengths and ratios and in favoring crown-class position. Volume growth was high in unthinned checks, and no thinning is recommended for pulpwood rotations. Infections by *Fomes annosus* were common after thinning, especially on stumps, but had no appreciable effect on growth or mortality of residual stands.

Little, Silas, and Horace A. Somes.

1968. **Herbicide treatments of Japanese honeysuckle for releasing desirable reproduction or for site preparation.** U. S. Forest Serv. Res. Note NE-83. 8 pp.

Various herbicides were used to release pine or hardwood seedlings from competition of Japanese honeysuckle, or to eliminate honeysuckle in areas being prepared for regeneration. 2,4-D emulsifiable acid is recommended with application in late fall for release of hardwoods and in late summer or early fall for release of pines. A mixture of 2,4-D–picolinic acid applied during spring or early summer is recommended as a conditioning treatment to prepare an area for new regeneration.

Lucas, John T., and Walter B. Wallin.

1968. **The Department of Defense market for wooden pallets: 1965.** U. S. Forest Serv. Res. Paper NE-117, 42 pp., illus.

The kinds and quantities of pallets needed, when and where the pallets are needed, how the pallets are purchased, sources of pallet supply, pallet prices, and problems associated with selling to DOD.

Lull, Howard W.

1968. **A forest atlas of the Northeast.** NE. Forest Exp. Sta. 46 pp.

A general reference work for the professional forester, conservationist, forestry-school student, and general public, containing 16 maps and accompanying text. The maps show present forest cover, forest land distribution, physiographic regions, soil characteristics, mean annual precipitation, mean annual snowfall, number of days with snow cover, temperature zones, mean annual potential evapotranspiration, mean annual water surplus, population distribution, and forest land ownership and recreation areas.

McCurdy, Dwight R., and Herbert Echelberger.

1968. **The hunting lease in Illinois.** J. Forestry 66: 124-127, illus.

Hunting lease arrangements vary with the activity for which the land is leased and the size of the investment in facilities required for the various activities. A written agreement is essential.

McGinnes, E. A., Jr.

1968. **Extent of shake in black walnut.** Forest Prod. J. 18(5): 80-82, illus.

Shake was found in over 4 percent of 10,500 black walnut logs examined in Missouri. Half of the shake was classed as ring shake. Macroscopic observations showed the separations to be between-cells rather than within cells.

McManus, M. L., and R. L. Giese.

1968. **The Columbian timber beetle, *Corthylus columbianus*. VII. The effect of climatic integrants on historic density fluctuations.** Forest Sci. 14: 242-253.

Multiple regression analyses were used to relate population fluctuations in basal sections of red and silver maple with summer and winter temperature.

precipitation, and number of days flooded. In southern Indiana precipitation accounted for 61 percent of the variation in beetle density, flooding 19 percent, and temperature 12 percent. The best model, incorporation all three variables, accounted for 95 per cent of the variation in beetle density through time and demonstrated the additive effects of previous climatic conditions.

Mader, Donald L., and Howard W. Lull.

1968. **Depth, weight, and water storage of the forest floor in white pine stands in Massachusetts.** U. S. Forest Serv. Res. Paper NE-109, 35 pp., illus.

Depths and weights of the forest floor in 65 white pine stands in Massachusetts are given by total accumulations and by layers. Differences in accumulation by geographic provinces and by soil parent materials are considered. Simple and multiple correlation and regression of forest floor and organic matter accumulations on age, basal area, site index, elevation, and soil drainage class are presented. Moisture storage and daily drying rates are evaluated for their possible effects on flood control.

Marquis, David A.

1968. **Changing concepts in hardwood management.** Ky. Gov. Conf. Forestry Proc. 5: 23-31.

Among the changing concepts are a trend to even-aged or clearcutting management, the increased emphasis on quality timber production (particularly aimed at the butt log), genetic improvement of hardwood trees, forest fertilization, and increased emphasis on site classification.

Martens, David G.

1968. **Flooring costs. A comparison of installation and maintenance costs for three types of residential flooring.** U. S. Forest Serv. Res. Paper NE-124, 23 pp., illus.

A national study of comparative maintenance and long-term costs of residential flooring materials showed that hardwood flooring had the lowest annual maintenance cost and lowest long-term cost when compared with composition tile and carpeting.

Martens, David G.

1969. **Flooring costs. A comparison of installation and maintenance cost for three types of residential flooring.** Flooring, January 1969: 67-74.

See above.

Marton, Renata, G. R. Stair, and E. J. Schreiner.

1968. **Influence of growth rate and clonal effects on wood anatomy and pulping properties of hybrid poplars.** TAPPI 51(5): 230-235.

A study of the wood anatomy and pulping properties of three poplar hybrids showed the influence of genetic factors (indicated by differences among clones) and environmental factors (indicated by differences among ramets within clones) on these properties. Anatomical analysis for all clones indicated significant intraclass correlation coefficients (0.05 level) for fiber length and specific gravity of sapwood but not of heartwood.

Mazzone, H. M.

1968. **Utilization of hemolymph in insect tissue culture.** 2nd Int. Colloq. on Invertebrate Tissue Culture: 14-21.

Data on the inhibition of melanin formation in hemolymph used in insect tissue cultures. Melanin is toxic to cells in culture and must be prevented from forming. Prevention was accomplished by: (1) chelation of the required copper

ions by SH compounds, (2) substrate inhibition by competitive analogues, and (3) use of nonhomologous hemolymph which does not contain the melanin forming system, i.e. the horseshoe crab (*Limulus polyphemus*) hemolymph.

Morrow, Robert R., and Carter B. Gibbs.

1968. **Vacuum pumping doubles maple sap yield on flat land.** USDA Forest Serv. Res. Note NE-91, 5 pp., illus.

Vacuum pumping more than doubled maple sap yield from tubing installations on nearly level land during the 1968 season. Increased yields were greatest when sap had to move slightly uphill.

Northeastern Forest Experiment Station.

1968. **Report 1967.** U. S. Forest Serv. NE. Forest Exp. Sta. Misc. Pub., 53 pp.

Highlights of Station activities and accomplishments, and an annotated list of publications on timber management, watershed management, forest economics, recreation, insects, diseases, and forest products utilization, marketing, and engineering.

Ostrander, Myron D.

1968. **Amendment to "Guide to hardwood log grading" (revised 1965).** U. S. Forest Serv. Res. Note NE-81, 2 pp.

The section on epicormic or adventitious bud clusters is modified.

Parker, Johnson.

1968. **Drought resistance of roots of white ash, sugar maple, and red oak.** U. S. Forest Serv. Res. Paper NE-95, 9 pp., illus.

The ability of root bark tissues of sugar maple (*Acer saccharum* Marsh.), white ash (*Fraxinus americana* L.), and red oak (*Quercus rubra* L.) to withstand reduction of moisture content to low levels was determined by placing thin sections of tissue in jars at different relative humidities. As determined by a dye absorption test, survival differences among species were not evident, but some seasonal variation occurred. When root segments were dried in the laboratory, maple roots lost weight (water loss through bark) more rapidly than the other two species. Oak and ash were not significantly different in rates of dehydration.

Parker, Johnson.

1968. **Drought-resistance mechanisms.** *In:* **Water deficits and plant growth,** Vol. 1, edited by T. T. Kozlowski: 195-234.

A summary of old and new information about the mechanisms by means of which plants combat drought. Although covering all the main plant phyla, it emphasizes woody plants. Drought-resistance mechanisms are taken up from two standpoints: those that tend to retain or maintain water in the plant and those that allow the protoplasm to desiccate to certain moisture levels without harm.

Patric, J. H.

1968. **Review of "Role of forests in water conservation".** J. Soil & Water Conserv. 23(5): 189.

After almost 50 years of research, American forest hydrologists believe that forests are heavy users of water and that removal of forests can increase streamflow. Some Russian hydrologists accept the American belief, but the majority—including the author—believe that water supplies on the drier plains can be augmented by afforestation.

Patric, James H., and Niranjan Goswami.

1968. **Evaporation pan studies** W. Va. Agr. & Forestry 1(4): 6-10, illus.

Because evaporation is controlled primarily by the sun's radiation and is influenced by temperature, humidity, and wind, the only accurate place to measure evaporation is at treetop level. Misleading forest climate data can be obtained if the evaporation pan is located in small forest clearings. Hills, buildings, trees, and even fences near pans can lead to error.

Plass, William T.

1968. **Tree survival and growth on fescue-covered spoil banks.** USDA Forest Serv. Res. Note NE-90, 4 pp.

In spoil-bank revegetation the emphasis today is on site protection. Quick cover crops overplanted to trees or shrubs are recommended on many sites. In this study to determine how an established fescue cover affects tree survival and growth, it was found that ground cover did not affect survival but did reduce the height growth of sycamore and sweetgum. It had little effect on growth of white pine and loblolly pine.

Quigley, Kenneth L.

1968. **A new look at Ohio's forest resources and industries.** Ohio Woodlands 6(3): 5-8, illus.

Ohio now has about 6.3 million acres of commercial forest land, or 24 percent of its area in forest. This will very likely continue to increase for the next 10 or 15 years. Among the species showing increases are white oak, red oak, hickory, soft maple, ash, yellow-poplar, black walnut, black cherry, and pine. Pulpwood production is increasing in a spectacular way, and today pulpwood vies with lumber logs as Ohio's most important primary timber product.

Reigner, Irvin C., William E. Sopper, and Roy R. Johnson.

1968. **Will the use of 2,4,5-T to control streamside vegetation contaminate public water supplies?** J. Forestry 66: 914-918, illus.

Riparian vegetation along two small headwater streams in Pennsylvania and New Jersey was treated with 2,4,5-T. Sniff tests were used to determine the degree of contamination. Results provide evidence that phenoxy herbicide, if applied with normal precautions, can be used on municipal watersheds without creating any water contamination.

Rexrode, Charles O.

1968. **Tree-wounding insects as vectors of the oak wilt fungus.** Forest Sci. 14: 181-189, illus.

Although more than 400 insects are known to attack oak trees, we do not know conclusively that any insect is the vector that transmits the oak wilt pathogen from a diseased tree to a healthy one. Many insects are suspect, but more knowledge about the biology of some insects is needed.

Rexrode, Charles O., and Charles R. Krause.

1968. **Rearing larvae of *Pseudopityophthorus pruinosus* and *P. minutissimus* on ground phloem media.** Ann. Entomol. Soc. Amer. 61: 814-816.

Two ground phloem media were developed for rearing larvae of two species of oak bark beetles. Larval survival averaged 88.1 percent with microbial inhibitors in the medium. Without microbial inhibitors, larval survival averaged 78.4 percent. The larvae were reared between two 4 X 4-inch glass plates.

Rexrode, Charles O., and Charles R. Krause.

1968. **Serial sections of *Pseudopityophthorus* spp.** Ann. Entomol. Soc. Amer. 61: 1340-1341, illus.

To study the internal anatomy of the oak bark beetle, *Pseudopityophthorus*

spp., a possible vector of the oak wilt fungus, the authors developed a new sectioning technique, which they describe in 16 steps. The timing of each step in the technique is important.

Reynolds, Hugh W.

1968. **Grading and unitized seasoning of oak cuttings.** Wood & Wood Prod. 73(10): 34.

The grade of dry wood can be predicted from cuttings made from green oak lumber. Green oak cuttings can now be dried successfully in unitized loads. The yield of dried cuttings is now high enough to make grading in the green and unitized drying economically attractive.

Roach, Ben A.

1968. **Is clear cutting good or bad?** Keep Ky. Green Assoc. KTG J. 8 (4): 5 pp.

A discussion of the pros and cons of clearcutting as a silvicultural system used in forest management, in relation to regeneration, the economics of forestry, and aesthetic considerations.

Roach, Benjamin A., and Samuel F. Gingrich.

1968. **Even-aged silviculture for upland central hardwoods.** U. S. Dep. Agr. Handb. 355: 39 pp., illus.

A guide to even-aged silviculture for upland central hardwoods that specifies the method of treatment that should lead to the most efficient production of timber within a timber stand. The handbook includes forest description, silvicultural objective, silvicultural system, selection of cutting areas, site-species relations, stand densities, stand inventory, stand diagnosis, silvicultural prescriptions for upland hardwoods, and application to small woodlands.

Safford, Lawrence O.

1968. **Ten-year average growth rates in the spruce-fir region of northern New England.** U. S. Forest Serv. Res. Paper NE-93, 20 pp., illus.

Results of a cooperative growth study on 766 plots in natural extensively managed stands. Plots were distributed among 27 stand-condition classes including three levels of stand composition, height, and density. The overall average annual net growth rate was estimated as 41.9 cubic feet per acre with a 2.1 percent sampling error. Stand composition had the strongest influence on forest net growth, which increased as the percent of softwood species increased. Spruce and fir made major contributions to net growth in all stand types.

Safford, Lawrence O., and Harold E. Young.

1968. **Nutrient content of the current foliage of red spruce growing on three soils in Maine.** Res. in Life Sci.: 27-31.

Basic information about the nutrient status of red spruce growing in natural stands on three different soil series in Maine. The design of the study enabled the researchers to compare foliar nutrient content of red spruce on different soils and on the same soil series in different places.

Sarles, R. L.

1968. **Components of a successful wood business: the marketing component.** Ky. Gov. Conf. Forestry Proc. 5: 83-87.

The marketing aspects of any business venture in wood products must receive top-priority consideration if the venture is to be successful. The market analyses of product potential should include determination of consumer preference and demand, product quality and specifications, product price, volumes that can be sold and where, production costs, margins for profit and risk, and market stability. These and other marketing factors are discussed.

Schreiner, Ernst J.

1968. **Forest tree breeding.** Unasylva 22(3): 3-9.

Salient points on sampling, evaluation, conservation, and utilization of genetic resources of forest trees are presented in the light of recent biological research. Examples and problems of exploration, collection, and conservation of tree species to provide for a broad genetic base for future breeding are discussed, as well as methodologies and objectives of gene pool collection and practical trials. Attention is called to the importance of international documentation, cooperation, and coordination in planning for the exploration and collection of genetic resources.

Schroeder, James G.

1968. **Lumber grade yields for sub-factory class red oak logs.** U. S. Forest Serv. Res. Paper NE-114, 15 pp., illus.

Lumber yields by grade are presented for construction class and local-use class red oak sawlogs. The application of the yields to a hypothetical sawmill cost structure shows that large sub-factory class red oak sawlogs can return a profit to the sawmill operator if they are sawed into standard factory lumber.

Schuster, Ervin G., and Thomas H. Pendleton.

1968. **Decisions on locating a new veneer plant.** S. Lumberman 217(2704): 211-216, illus.

A study of the decision-making process used by a veneer manufacturer to select a community in which to build a new plant. Availability of raw materials, transportation costs, markets, and availability of reasonable cost financing were major factors in selecting the region; and labor supply, utilities, plant sites, living conditions, and community attitudes were considered in choosing the community.

Seliskar, C. E.

1967. **Oak wilt *Ceratocystis fagacearum* (Bretz) Hunt. *In* Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 173-176, illus.

A brief description of the distribution, hosts, damage, life history, and control of oak wilt *Ceratocystis fagacearum* (Bretz) Hunt.

Shafer, Elwood L., Jr.

1968. **Recent recreation research implications from the physical and biological sciences.** Parks & Recreation 3(8): 22-24, 51-52, illus.

The traditional methods of the social sciences are proving inadequate to the task of dealing effectively with the growing complexity of recreation problems. These inadequacies are now being remedied by new developments in the physical and biological sciences.

Shafer, Elwood L., Jr.

1968. **Recent contributions to recreation research from related disciplines.** Nat. Recreation and Park Assoc. Congr. for Recreation and Parks 1967: 109-111.

The Forest Service has been investigating a new approach to prevent large avalanches in ski areas by modifying snow by chemical rather than mechanical means, has developed a mathematical equation for predicting the preferences of recreationists for various types of landscapes, and in the long process of restoring the cleanliness of streams, has developed two types of sewage treatment that are now in use.

Shafer, Elwood L., Jr.

1968. **The demand for water-oriented outdoor recreation.** Parks & Recreation 3(2): 22-24, 57.

Methods of integrating various and conflicting water-recreation activities in the same environment are suggested, based on recreation surveys, personal observation, and discussions with resource planners and users of outdoor recreation facilities.

Shafer, Elwood, L., Jr., John F. Hamilton, Jr., and Elizabeth A. Schmidt.

1968. **Natural landscape preferences: a predictive model.** J. Leisure Res. 1(1): 1-19.

A report on a study to identify what quantitative variables in photographs of landscapes are significantly related to public references for those landscapes. Using factor and multiple-regression analyses, an equation was developed that used six variables and accounted for 66 percent of the variation in preference scores for photographs of landscapes. The authors conclude that it is possible to quantify aesthetics.

Shafer, Elwood L., Jr., and Stephen A. Liscinsky.

1968. **Design & analysis for multiple-use studies of deer browse & timber production.** U. S. Forest Serv. Res. Paper NE-100, 25 pp., illus.

A report on an experiment to compare the production of dormant woody deer browse under different intensities of cutting. If similar experiments are conducted in forest stands as uniform as the one used in this study, the authors recommend using a completely randomized design with 54 subplots per treatment plot and 3 replications per treatment.

Shafer, Elwood L., Jr., and Roger C. Thompson.

1968. **Models that describe use intensity of Adirondack campgrounds.** Forest Sci. 14: 383-391.

Factor analysis was used to isolate groups of linearily independent variables that describe the physical environment of camping areas. The interrelation between use intensity and environmental features was determined with regression analysis. The analytical approach applied to outdoor recreation in this study is applicable to many areas of research where a large number of interrelated explanatory variables must be employed.

Shigo, Alex L., and Lawrence Kilham.

1968. **Sapsuckers and Fomes igniarius var. Populinis.** U. S. Forest Serv. Res. Note NE-84, 2 pp., illus.

In aspen trees infected by *Fomes igniarius* var. *populinus*, the thin shell of sound wood enclosing the central column of decayed wood offers an ideal place for yellow-bellied sapsuckers to peck out nests. Sapsucker damage is concentrated near nesting areas.

Shigo, Alex L., and Edward M. Sharon.

1968. **Mapping columns of discolored and decayed wood in sugar maple.** (Abstr.) Phytopathol. 58:1067.

Columns of discolored and decayed wood associated with 8-year-old inoculations with heart rot fungi in 10 trees (*Acer saccharum*) were mapped for specific gravity, pH, moisture, ash, and microorganisms. As specific gravity increased, the other factors decreased from very high levels to the levels found in clear wood. Isolation maps showed that decayed tissues that yielded Hymenomycetes were surrounded by discolored tissues that yielded bacteria and nonhymenomycetous fungi.

Shigo, Alex L., and Edward M. Sharon.

1968. **Discoloration and decay in hardwoods following inoculations with hymenomycetes.** Phytopathol. 58:1493-1498, illus.

Wooden dowels, either sterile or infested with a Hymenomycete, were inserted aseptically into six species of living hardwood trees. Five years later, 236 of the trees were dissected and studied. Discoloration was associated with every wound. Bacteria and non-Hymenomycetes invaded first, followed by Hymenomycetes. The fungus introduced was recovered from 20 percent of the trees.

Shigo, A. L., and G. L. Stone.

1967. **Beech bark disease *Nectria coccinea* Pers. ex Fr. var. *faginata* Lohm., Wats., and Ayers.** *In* **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 195-198, illus.

A brief description of the distribution, hosts, damage, life history, and control of beech bark disease *Nectria coccinea* Pers. ex Fr. var. *faginata* Lohm., Wats., and Ayers.

Shottafer, J. E.

1968. **Potential production: plywood from eastern spruce.** Forest Prod. J. 18(10): 18-21, illus.

Conditions for the production of structural plywood from eastern spruce in the Northeast seem favorable. An adequate raw-material resource and a potential market do exist, and experience of current production operations does not reveal critical technical problems.

Smith, H. Clay

1968. **Bark thickness: is it important?** Nat. Maple Syrup Dig. 7(3): 19.

Bark thickness on sugar maple trees increases as the size of the tree at tapping height increases. Accordingly, when drilling any taphole one should consider both wood depth and bark thickness. The larger the tree, the thicker the bark, and the deeper one should tap. The author presents a guide to bark thickness based on tree diameter at tapping height.

Snow, Albert G., Jr.

1968. **Our sugar maple resource: report on the Houghton sugar maple conference.** Seventh Conf. on Maple Prod. Proc.: 15-16.

More than 50 specialists told the more than 250 participants in the conference what is known—and not known—about the sugar maple resource and the maple sugar industry. Present knowledge can be used in managing a sugarbush for better production, and efforts to increase knowledge presage a bright future for utilization of the sugar maple resource.

Solomon, Dale S.

1968. **Applying site-index curves to northern hardwoods in New Hampshire.** U. S. Forest Serv. Res. Note NE-79, 5 pp.

A new method for testing site-index curves. Study results indicate that Vermont site-index curves for yellow birch, paper birch, white ash, and sugar maple, and New York-Connecticut curves for red maple, can be applied satisfactorily in New Hampshire when used with certain precautions and corrections.

Solomon, Dale S., and Richard J. Nolet.

1968. **Reliability of tree-height measurements in northern hardwood stands.** U. S. Forest Serv. Res. Note NE-86, 3 pp.

No significant differences were found between the heights of standing hardwood

trees estimated with a Haga altimeter and actual heights measured after the trees had been felled. Differences ranged from +10 feet to −12 feet, and the mean difference for all trees was 0.1 foot.

Sopper, W. E., and H. W. Lull.

1967. **An evaluation of streamflow timing from small watersheds in northeastern United States.** 14th IUFRO Congr. Sect. 11: 281-297.

Daily streamflow records for a 17-year period from small watersheds, less than 100 square miles in area, were utilized to evaluate streamflow timing. Criteria used to characterize streamflow timing were high-flow and low-flow intervals.

Stern, E. George.

1968. **Nailed 48" by 40" picture-frame plywood-deck pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 67, 20 pp.

A report on performance characteristics of plywood-deck pallets: the use of hardwood may be given preference when optimum performance is required from pallets; nailing without gluing can be considered fully satisfactory; and a poorly threaded nail should not be used in pallet assembly.

Stern, E. George

1968. **Nailed 48" by 40" Douglas fir lumber and plywood pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 68. 24 pp.

Performance characteristics were determined for 5 types of pallets made of Douglas-fir lumber and plywood and suggested for use in the nationwide grocery industry pallet pool. Extreme rigidity of the plywood deck pallets can be reduced by replacing the single plywood deck with 2 to 4 plywood pieces.

Stern, E. George.

1968. **Laboratory evaluation of 48" by 40" hardwood lumber pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 69, 12 pp.

Data from free-fall drop tests performed on five types of hardwood pallets to obtain comparative information on design and performance. Four of the types tested performed satisfactorily in rigidity; additional nailing was recommended for the other.

Stern, E. George.

1968. **Laboratory evaluation of 48" by 40" oak pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 70, 8 pp.

Free-fall drop tests were performed on quintuple pallets to obtain comparative information on rigidity. Tests were also performed on the resistance to separation of the 1-by-6-inch top and bottom deckboards from the center stringer of the sixth pallet.

Stern, E. George, and Walter B. Wallin.

1968. **Report on laboratory testing of PEP pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 71, 15 pp.

Free-fall drop tests were performed on 13 types of wooden pallets to measure their rigidity and resistance to shock and impact. Minor changes in stringers and nailing are recommended for five types.

Stratton, K. G., L. O. Safford, and R. A. Struchtemeyer.

1968. **Two fertilizer studies with white pine in Maine.** Res. in Life Sci.: 1-6.

Eight treatments with nitrogen, potassium, and phosphorus were tried in two plantations, one on a droughty loamy sand soil on a kame terrace, the other on a

sandy loam soil on an alluvial terrace. Results show the importance of soil condition, because identical treatments in planted stands of the same species and age class gave different results, maybe due to differences in natural fertility of the two sites.

Swingle, R. U., and R. R. Whitten.

1967. **Dutch elm disease *Ceratocystis ulmi* (Buism.) C. Moreau.** *In* **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub 1180: 177-180, illus.

A brief description of the distribution, hosts, damage, life history, and control of Dutch elm disease *Ceratocystis ulmi* (Buism.) C. Moreau.

Talerico, Robert L.

1968. **Life history of the Looper *Phigalia titea* in Virginia.** Ann. Entomol. Soc. Amer. 61: 557-561, illus.

The life history and natural enemies of this obscure hardwood defoliator. The insect occurs in the eastern half of the United States. It overwinters as a pupa in the soil, and has one generation a year. The species progresses through five instars during larval development.

Thomas, J. W., R. M. Robinson, and R. G. Marburger.

1967. **Use of diazepam in the capture and handling of cervids.** J. Wildlife Manage. 31: 686-692, illus.

Orally administered diazepam was used to capture 105 deer of six species in five field trials. Diazepam made it possible to hold wild deer in close captivity and facilitated handling both wild and tame deer. Dosages and methods are discussed.

Trimble, George R., Jr.

1968. **Growth of Appalachian hardwoods as affected by site and residual stand density.** U. S. Forest Serv. Res. Paper NE-98, 13 pp.

In a 10-year growth study, Appalachian hardwoods were cut to different residual basal areas on an excellent site (index 85 for oak) and a fair site (index 63 for oak). There were large differences in growth between the two sites, the excellent site producing 1.4 times more cubic volume and 2.1 times more board-foot volume than the fair site. Apparently the lower density on the excellent site reduced stocking of larger trees to a point below full occupancy. Growth rates of the individual residual trees were greatest at the lowest density, regardless of size.

Trimble, George R., Jr.

1968. **Multiple stems and single stems of red oak give same site index.** J. Forestry 66: 198.

The relationship between site index of multiple stems and single stems was determined on seven 1/5-acre plots in West Virginia. Analysis of variance with the data revealed no significant difference at the 5-percent level in site index between multiple and single stems of dominant and codominant trees. Measurements of length of clear bole were made on the same sample trees. Comparisons of these data of single–and multiple-stemmed trees also showed no differences.

Trimble, George R., Jr.

1968. **Diameter increase in second-growth Appalachian hardwood stands–a comparison of species.** USDA Forest Serv. Res. Note NE-75, 5 pp.

A study of growth at d.b.h. among eight hardwood species after partial cutting in second-growth stands. Red oak grew fastest, followed in order by yellow-poplar, sugar maple, basswood, black cherry, white ash, beech, and chestnut oak.

Trimble, George R., Jr.

1968. **Form recovery by understory sugar maple under uneven-aged management.** U. S. Forest Serv. Res. Note NE-89, 8 pp., illus.

A study of advanced sugar maple reproduction on a good site in West Virginia indicated that considerable improvement of stem form takes place after selection cutting in the overstory. To an appreciable extent, flat tops and minor crooks were overcome after partial release.

Trimble, George R., Jr.

1968. **Log grades should reflect lumber grades.** N. Logger 16(11): 24.

Any grading system for factory logs should be based on converting the log to standard grades of lumber and should be supported by adequate data showing the lumber-grade yields for those log grades. A grading system that is both simple and accurate cannot be developed cheaply.

Trimble, G. R., Jr.

1968. **Harvest cuttings in Appalachian hardwoods from a silvicultural viewpoint.** *In* W. Md. Forest Impr. Conf. Proc. 9 pp.

Many factors—including species requirements for regeneration and growth, site quality, present logging equipment, and market conditions—favor even-aged management over uneven-aged management.

Trimble, G. R., Jr.

1968. **Research findings on even-aged management of hardwoods in the Appalachian area and the Central States.** Monongahela Nat. Forest Timber Manage. Conf. Proc., 15 pp.

The argument for even-aged management, with emphasis on timber production and water relationships.

Vogel, W. G., and W. A. Berg.

1968. **Grasses and legumes for cover on acid strip-mine spoils.** J. Soil and Water Conserv. 23(3): 89-91, illus.

Even where the ultimate goal in reclamation is reforestation, herbaceous vegetation can provide the quick cover necessary to minimize runoff and erosion while trees are becoming established. Weeping lovegrass provides initial cover on extremely acid spoils faster than any other perennial grass or legume. The studies involved both field and greenhouse experiments.

Vogel, W. G., and A. J. Bjugstad.

1968. **Effects of clipping on yield and tillering of little bluestem, big bluestem, and indiangrass.** J. Range Manage. 21(3): 136-140, illus.

Clipping little bluestem, big bluestem, and indiangrass for 3 successive years at the seed-ripened stage or later increased yields and spring-initiated tillering of plants in a prairie-like glade grassland in the Missouri Ozarks. Clipping at any time during the summer reduced yields, but clipping between floral initiation and anthesis was the most damaging to plants.

Wahlgren, Harold E., Gregory Baker, Robert R. Maeglin, and Arthur C. Hart.

1968. **Survey of specific gravity of eight Maine conifers.** U. S. Forest Serv. Res. Paper FPL-95, 12 pp., illus. Madison, Wis.

This analysis of a mass increment core sampling of eight coniferous species of Maine characterizes specific gravity for each species. No clear-cut relationships of

specific gravity to forest type, stand-density class, age class, or tree diameter at breast height were found.

Wallace, Oliver P., Sr., and Richard D. Hopkins.
1968. **Estimated financial returns from two white pine plantations.** N.H. Agr. Exp. Sta. Bull. 496, 24 pp., illus.
Presents a method for evaluating investment opportunities for plantation establishment.

Walters, Russell S.
1968. **Christmas tree report.** Ohio Woodlands 6(2): 16-18.
Superior Christmas trees may be available for planting within the next few years, thanks to the introduction of new or exotic species, selection of superior races or individuals, selective breeding and hybridization, and polyploidy and mutation breeding.

Walters, Russell S.
1968. **Other products of the forest.** Ohio Woodlands 6(1): 17-18.
Owners of small forests in Ohio can often make money from growing and harvesting such special forests products as Christmas trees, medicinal plants, decorative plants, and edible plants. The author lists many income-producing plants.

Walters, Russell, S.
1968. **Scotch pine seed available from Turkey.** Amer. Christmas Tree J. 12(3): 9.
A description of the procedures for obtaining a superior Scotch pine seed from Turkey. This information will enable Scotch pine Christmas tree growers to obtain planting stock of this desirable source and grow good quality trees more easily and cheaply than by using less desirable sources.

Wartluft, Jeffrey L., and Charles H. Wolf.
1968. **Profit possibilities with hardwood bark.** S. Lumberman 217(2704): 217-219.
Hardwood bark that accumulates at Appalachian sawmills is costly to dispose of, but there are profitable ways to put it to use: as fuel, mulch and soil conditioner, poultry litter, cattle bedding, charcoal, etc. Raw-material requirements and processing methods are outlined for preparing and marketing bark mulch and soil conditioner.

Waters, W. E., and R. J. Finnegan.
1967. **Pales weevil *Hylobius pales* (Hbst.). *In* Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 108-110, illus.
A brief description of the distribution, hosts, damage, life history, and control of the pales weevil *Hylobius pales* (Hbst.).

Wayt, William A., Robert W. Acton, James C. Whittaker.
1968. **A look at commercial recreation on small woodlands in Ohio.** U. S. Forest Serv. Res. Paper NE-101, 11 pp., illus.
A report on case studies of five commercial recreation developments on small private woodlands in Ohio, suggesting what an investor must consider in undertaking such an enterprise.

Weigle, Weldon K., and George P. Williams, Jr.
1968. **Match additive to soil types for best stabilization.** Rural and Urban Roads, June 1968: 24-25.

Asphalt, sealing oil, and mixing oil appear to offer promise as stabilizing additives for silty loam soil used as a base for coal haul roads. The stabilizing agent should be matched to the soil type.

Wendel, George W., and George R. Trimble, Jr.

1968. **Early reproduction after seed-tree harvest cuttings in Appalachian hardwoods.** U. S. Forest Serv. Res. Paper NE-99, 16 pp., illus.

Three years after seed-tree cuttings in Appalachian hardwood stands, and immediately after the removal of the seed trees, small reproduction (stems 1 foot tall to 1 inch d.b.h.) of desirable species was abundant and well-distributed, and was composed of a large proportion of seedling-origin stems. Both species composition of the reproduction and relative abundance of the different species varied greatly with site quality.

Whittaker, James C.

1968. **Land leasing—An aid to developing outdoor recreation enterprises in Indiana, Kentucky, and Ohio.** U. S. Forest Serv. Res. Paper NE-113, 12 pp., illus.

Information about individuals and organizations that lease privately owned land for recreational purposes. Based on a questionnaire survey to find out how and why they leased land.

Whittaker, J. C., and H. E. Echelberger.

1968. **New York Section members' attitudes about forest recreation and associated research.** Soc. Amer. Foresters, N. Y. Forester 25(1&2): 48-50.

New York Section members of the Society of American Foresters were canvassed by mail to determine their attitudes and opinions about aspects of forest recreation and associated research. Members were questioned on the importance of recreation in land use, land acquisition, entrance fees, public vs. private recreation lands, whether recreation deserves more emphasis, the effectiveness of material published on forest recreation, forest recreation activities, and kinds of recreation research that should be emphasized.

Whitten, R. R., and W. A. Reeks.

1967. **Native elm bark beetle *Hylurgopinus rufipes* (Eichhoff).** ***In*** **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 114-116, illus.

A brief description of the distribution, hosts, damage, life history, and control of the native elm bark beetle *Hylurgopinus rufipes* (Eichhoff).

Whitten, R. R., and W. A. Reeks.

1967. **European pine sawfly *Neodiprion sertifer* (Geoff.).** ***In*** **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 134-137, illus.

A brief description of the distribution, hosts, damage, life history, and control of the European pine sawfly *Neodiprion sertifer* (Geoff.).

Whitten, R. R., and W. A. Reeks.

1967. **Smaller European elm bark beetle *Scolytus multistriatus* (Marsham).** ***In*** **Important Forest Insects and Diseases of Mutual Concern to Canada, the United States and Mexico.** Can. Dep. Forestry and Rural Develop. Pub. 1180: 167-170, illus.

A brief description of the distribution, hosts, damage, life history, and control of the smaller European elm bark beetle *Scolytus multistriatus* (Marsham).

Wollerman, E. H.
1968. **Studies of borer resistance in black locust.** Entomol. Soc. Amer. North Cent. States Br. Proc. 23(1): 45.
An evaluation of borer resistance and the comparative influences of genetic composition and site. Presents standards to measure advances by. Reports pertinent data on tree growth, borer counts, and infested-tree ratios.

Wollerman, E. H.
1968. **A search for borer resistance in black locust.** Proc. Sixth Cent. States Forest Tree Impr. Conf.
Selected trees have been vegetatively propagated and planted in study plots. A clone designated BN-8450 has shown a 58 percent reduction in borer attack in an area of high borer population and 96 percent in an area of low population. Borer resistant strains of black locust could provide forest products where none are now possible because of the damage caused by the borer.

Worley, David P.
1968. **The challenge in education and training.** Ky. Gov. Conf. Forestry Proc. 5: 61-62.
The basic challenge in education and training is to make the crossover from the old to the new as painless as possible. How to effect a collaboration between technologists and managers is another challenge. Because the computer makes possible detailed evaluation of the tangible aspects of a number of alternatives, the decision-maker has more time to consider the intangibles involved. Developing and operating such decision systems is still another challenge.

Worley, David P. and Hoyt A. Wheeland.
1968. **An economic evaluation of cull-tree removal in mixed hardwood stands.** U. S. Forest Serv. Res. Note NE-82, 5 pp.
A comparison of inventories of six mixed hardwood compartments on the Kaskaskia Experimental Forest—made 12 years apart—shows that the three that received a cull-removal treatment as well as group-selection harvests were moving toward achieving sustained yields of medium to large sawtimber more rapidly than the three that had received only the group-selection harvests. Cull removal created value differences great enough to pay for the treatment two times out of three.

Yawney, Harry W., and Clayton M. Carl, Jr.
1968. **Sugar maple seed research.** USDA Forest Serv. NE. Area State & Private Forestry 20th Anniversary Nurserymen's Conf. Proc.: 115-123.
A summary of results from the Station's seed research at Burlington, Vt.: timing of seed collections; methods for separating filled from empty samaras, procedures for drying seed, long-term storage requirements; methods of seed testing; and time and methods for sowing seed in the nursery.

Yawney, Harry W., and G. R. Trimble, Jr.
1968. **Oak soil-site relationships in the Ridge and Valley region of West Virginia and Maryland.** U. S. Forest Serv. Res. Paper NE-96, 19 pp., illus.
An oak soil-site study showed that heights of the five oak species studied (red, scarlet, black, chestnut, and white oak) could be predicted from measurements of five factors: stand age, aspect, slope position, thickness of the A + B horizons,

and pH of the A_2 horizon. Compared to a previous study made in the Mountain Region to the west where rainfall was much greater, site index in the Ridge and Valley Region was appreciably lower for comparable soil and topographic locations.

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